Management Strategies for Electric Vehicle Fleets

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Abstract

The research leading to these results has received funding from the EU 7th FP under the project DATA science for SIMulating the era of electric vehicles (DATASIM, FP7-ICT-270833). DATA SIM aims at providing an entirely new and highly detailed spatial-temporal microsimulation methodology for human mobility with the goal to forecast the nation-wide consequences of a massive switch to electric vehicles. The objective of this work is focused in the development of charging management strategies for electric vehicle (EV) fleets. Its purpose is to maximize the integration of EVs in the current electric grid considering their consumption and their charging limits, both temporal and spatially. The main contribution of this work is the development of a novel Peer to Peer Energy Trading System (P2PETS) between EVs in order to reduce the impact of charging EVs over the electric grid.

P2P Energy Trading System

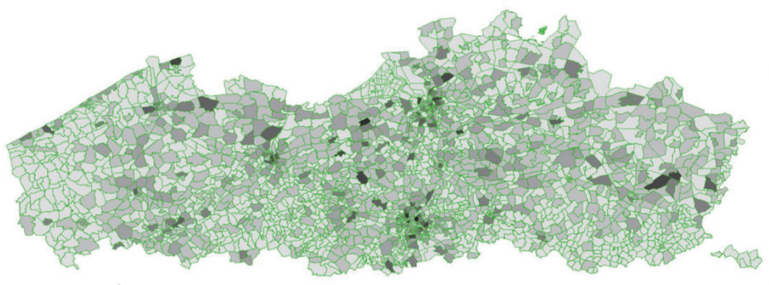
Activity Based Mobility Model & Driver Classification

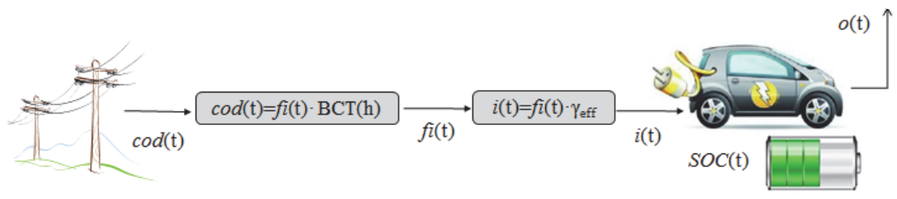
The temporal and spatial behavior of EVs is modeled using an activity-based (AB) micro-simulation model that predicts the daily scheduled activities for each member of a synthetic population in Flanders region (Belgium). This region is divided in 2368 different traffic analysis zones (TAZ) and a complete schedule list for the whole population is obtained, allowing to know for each member of this population when, where and which activities are done and the transportation mode used (by foot, by train, by car, etc.).

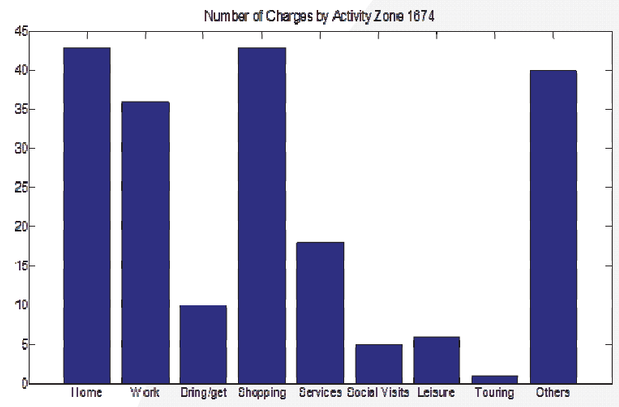
Based on this AB model, all current car drivers in Flanders region have been classified in three different sets according to their daily consumption.

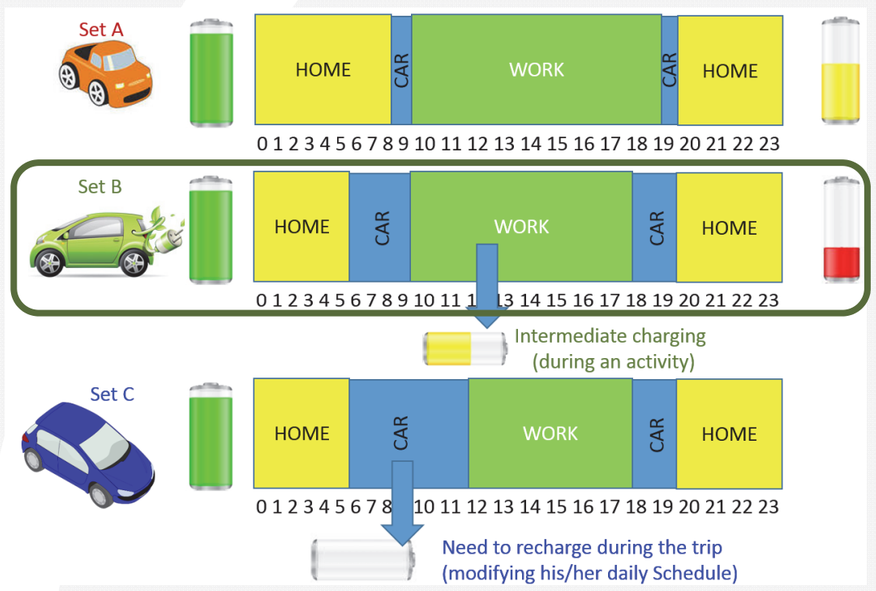
Charging cost and location

For each driver from set B, the optimal charging cost is calculated. For each zone, the activities performed by the drivers while charging are also evaluated.





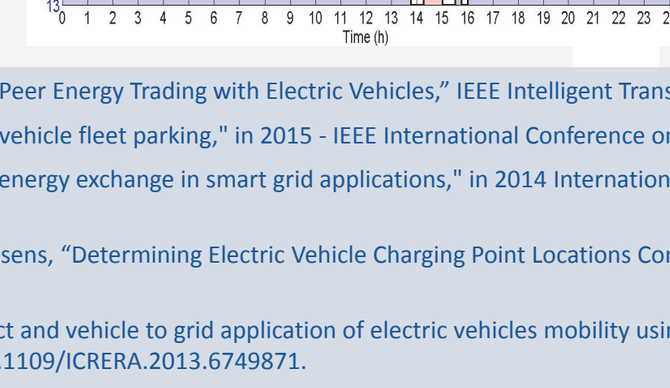




P2P Electricity market

- A P2P trading system that interconnects both market actors: vehicles with an energy surplus at the end of the day (set A) and vehicles demanding extra energy along the day (set B).
- An aggregator sets the energy and the price to be given to set A vehicles depending on demand, energy stored in set A vehicles and grid price.
- P2P electricity price highly depends on ratio between set B and set A vehicles. This ratio is usually low.
- Total charging costs for both vehicles sets is diminished. The P2P Energy Trading System is day-charging independent.

Set A: Energy surplus



Set B: Energy demand

Set A: P2P Energy trading

Set B: P2P Energy trading

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